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A SUMMARY OF THE POPULATION OF INJURIOUS INSECTS IN KANSAS FOR 1931*

By

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Studies on Project No. 6 of the Agricultural Experiment Station (Climate and Insects) have been greatly hindered by not having sufficient information regarding the yearly population of insects in the state, and because such information as is available is not recorded in comparable terms. It is difficult to interpret, particularly for comparison between years, or to correlate with climatic factors such recorded expressions as "very abundant", "damaging a fifty-acre field", or "more (or less) damage than usual."

An attempt, therefore, is being made to make use of all of the most reliable and best informed sources of information in the state on the insect population, and to record or express this population in mathematical terms (2). The writer is well aware of the weaknesses of this plan and methods which have been used.

It is so much better, however, than anything previously undertaken in the way of recording the population of Kansas insects, that it seems well worth undertaking particularly in view of the small expenditure of money involved. This paper is a summary of the first year's work and it is planned to issue such a report an-

* Contribution No. 397 from the Department of Entomology.

(1) The entire staff of the Department of Entomology has contributed in one way or another to this report. Especial mention should be made of information supplied by Dr. E. G. Kelly, Extension Entomologist. Mr. Floyd K. Reed, U. S. Crop Statistician, Topeka, Kansas, cooperated in securing data. The Division of Extension at the college, particularly the county agents, cooperated splendidly in filling out and returning questionnaires. Mr. Fred Walker and Mr. P. G. Lamerson assisted in summarizing the questionnaire data.

(2) The summary for the United States, given by the Insect Pest Survey for 1931 (Vol. 11, No. 10, 1931, pp. 651-688), was consulted and the information there, supplied largely by Professor H. R. Bryson, has been used as far as possible.

nually. The methods employed are certainly subject to improvement and it is expected that future reports will attain a much higher degree of accuracy and hence improve in value.

A Summary of the Weather for Kansas During 1931 (3)

"The year, 1931, averaged the warmest on record, except 1921, in practically every part of Kansas and the fall of moisture was the lightest since 1926.

"The average temperature of the year, 57.4 degrees, was 2.9 degrees above normal.

Table I.—Summary of Weather Data for the State of Kansas for the Insect Year, Sept. 1, 1930 to Dec. 31, 1931.

Year	Month	Temperature					Precipitation, inches		
		State Average	Maximum	Minimum	Average for 44 Years	Departure from Normal	State Average	Average for 44 Years	Departure from Normal
1930	September	70.8°	102°	28°	69.4°	1.4°	3.00	2.8	+0.12
1930	October	65.0°	94°	13°	66.8°	−2.0°	3.63	2.02	+1.72
1930	November	45.0°	88°	14°	43.1°	1.1°	2.43	1.22	+1.21
1930	December	33.8°	68°	10°	32.6°	1.9°	0.38	0.88	−0.82
1931	January	36.4°	75°	−4°	29.4°	+7.0°	0.26	0.66	−0.36
1931	February	41.7°	79°	8°	33.8°	+7.9°	0.98	1.04	−0.03
1931	March	39.1°	88°	−3°	43.1°	−4.6°	2.41	1.49	+0.92
1931	April	63.1°	90°	20°	64.7°	−1.0°	2.41	2.67	−0.29
1931	May	60.6°	99°	28°	63.6°	−2.7°	2.89	3.74	−0.75
1931	June	77.8°	106°	44°	73.8°	+4.6°	2.15	4.06	−1.91
1931	July	80.4°	113°	48°	78.4°	+2.1°	2.32	3.36	−1.03
1931	August	76.0°	109°	43°	77.3°	−1.4°	3.27	3.10	+0.17
1931	September	77.6°	111°	31°	69.8°	+8.2°	2.80	2.80	−0.36
1931	October	61.7°	99°	10°	56.9°	+4.8°	1.60	2.01	−0.62
1931	November	46.2°	87°	1°	43.2°	+2.6°	4.46	1.29	+3.11
1931	December	38.9°	75°	2°	31.7°	+7.0°	0.65	0.86	−0.19

(3) Flora, Snowden D., Climatological Data, Kansas Section, General Summary, 1931:43. No. 13 pp 97,101.

The highest reported was 113 degrees on July 22 at Russell and lowest, 4 degrees below zero on January 14 at Norton and near Burr Oak, Jewell County. No other year on record has passed without a lower temperature than this somewhere in Kansas.

"The average precipitation over the eastern third was 36.88 inches; the middle third, 25.14 inches; the western third, 15.66 inches; and for the State, 25.90 inches, which is 1.24 inches below normal. The greatest annual amount recorded was 51.93 inches at Holton, and the least, 9.15 inches at Irene, Hamilton County.

"The year began with exceptionally mild and pleasant weather through January and February, followed by a

wintry March that averaged colder than February. On March 26 the western third of the State was struck by the worst blizzard in 45 years. Thousands of head of live stock perished and many persons had narrow escapes from death. Highways were blocked for days by huge snow drifts. Train service on main lines was paralyzed for 24 to 36 hours.

"This was followed by a cool April and May that were favorable for wheat but delayed farm work and caused much corn to be replanted. An unreasonably late freeze occurred May 20-22 over the western third of the State and the north-central counties but without much damage except to truck crops.

"An unusually hot July did much damage to corn over the southern half of the State and the central counties. This was followed by a comparatively cool and pleasant August and the warmest 4-month period with which any year on record has closed. September, for the first time on record, averaged warmer than August. Killing frosts did not generally occur until near the end of October by which time all important crops had matured.

"There was an excessive amount of soil moisture over the eastern two-thirds of Kansas through November and December, and heavy snows fell over the northwestern counties the latter part of November, which were fine for wheat in those sections. A persistent dry spell in the southwestern counties the last four months of the year was very unfavorable for wheat."

How the Data were Obtained

A questionnaire of the score-card type (Table II) was devised and sent to the following groups of persons in the state as representing best available sources of information on the subject:

Group 1—Entomologists. Staffs of Kansas State College, Kansas University, the Wichita laboratories, and the extension Entomologist, the report of the latter being regarded as particularly significant.

Group 2—County Agents and vocational agriculture teachers. Most of these men have had at least one course in Entomology.

Group 3—Selected farmers and others not included in the above two groups.

Questionnaires were sent out about the first of July and first of October. The list of the insects included in the two questionnaires differed slightly. The instructions accompanying the questionnaires and the two lists of insects were as follows:

"This is a questionnaire on insect abundance and insect damage, by counties, in Kansas. It is being sent to a number of persons in the months of July and October in an effort to obtain reliable information on the presence (or absence) of injurious insects in the state.

DIRECTIONS: Indicate by number according to the following key, your estimate of damage or abundance of the species listed at the top of each column, either from (a) personal observation or (b) reliable reports in one or more counties. Fill in for as many insects as you can in the list across the top of this report. Do this for as many counties of Kansas as you have information. The period to be covered by this report is the four months prior to the date the blank is filled out.

KEY: Place 0—in the square at the head of the column when you have not seen the particular kind of insect or have had no reports of its presence in the county.

1—A few individual insects actually seen or the species has been reported scarce.

2—Plentiful but no noticeable or reported damage.

3—The species abundant, some damage having been seen or reported.

4—Local outbreaks, the species caused severe damage in certain fields.

5—The species present in a general outbreak. This rating is given only when the insects did their most severe damage or were as plentiful as they ever get in your locality.

If the record is based upon personal observation insert an **a** after the numeral; if based upon reports insert a **b.**

EXAMPLE: **3a** means that you have observed personally that the particular insect was plentiful and that it did some damage.

Ob means that reports indicate that the insect in question has been absent from the county being reported upon.

Table II. Headings of July and October Questionnaires

a—July		Name of County
		Army worms
		Blister beetles (alfalfa, gardens)
		Bot flies (horses)
		Cabbage worms
		Cattle grubs or warbles
		Cattle lice
		Chinch bugs
		Corn bill bugs
		Corn ear worms
		Cutworms (state crop attacked)
		Fall army worms
		Fleas—in houses
		Flies—on cattle
		Garden web-worm (alfalfa, gardens)
		Grasshoppers
		Grain weevils (wheat, corn)
		Green bug (wheat)
		Harlequin bug (cabbage, rape, kale)
		Hessian fly (wheat)
		Horse flies (large flies)
		Mites (on wheat, arbor-vitae)
		Plant lice (state crop attacked)
		Red spiders (mites)
		Scales (name hosts)
		Seed corn maggot (seeds, potatoes)
		Sod web-worm (corn)
		Strawberry leaf roller
		Tent caterpillars
		Termites
		Walnut worms (Datanas)
		Wheat straw worms
		White grubs (June bugs)
		Wire worms

Table II. (Continued).

b—October		Name of County
		Bag worms—Arbor-vitae, apple
		Blister beetles (alfalfa, gardens)
		Bot flies (horses)
		Borers (state tree involved)
		Cabbage worms
		Canker worms
		Cattle grubs or warbles
		Chinch bugs
		Corn bill bugs
		Corn ear worms
		Corn stalk borers
		Cotton worm moths
		Fall army worms
		Cutworms (state crop attacked)
		False wireworm
		Fleas—in houses
		Flies—on cattle
		Garden web-worm (alfalfa, gardens)
		Grasshoppers
		Grain weevils (wheat, corn)
		Harlequin bug (cabbage, rape, kale)
		Hessian fly (wheat)
		Horse flies (large flies)
		Leafhoppers (state crop attacked)
		Mange mites (hogs)
		Mange mites (cattle)
		Plant lice (state crop attacked)
		Scales (name hosts)
		Strawberry leaf roller
		Tent caterpillars
		Termites
		Tomato worms
		Walnut worms (Datanas)
		Wheat straw worms
		White grubs

Please fill out for your county and for any other counties if possible but leave blank squares under kinds

of insects about which you have no information, and return promptly.

Date of Report..... Name of Reporter.....

Address.....

This report covers the four months ending with the above date."

Criticisms of the Data Obtained

The writer is well aware of the common faults of questionnaire data in general. However, much of the information of the cooperating entomologists was acquired by travel over the state and by frequent sweepings or surveys during the course of experimental work during the season. Where there was wide disagreement in reports, the rating given by the Extension Entomologist, Dr. E. G. Kelly, has been accepted as probably being the more accurate.

The six categories readily fall into three; namely, scarce, average and heavy. Zero and 1, which, manifestly, do not differ significantly, indicate that the insect was scarce. Zeroes were not included in the preparation of the insect maps or in the averages, since **a priori** every insect in the list could be graded at 1, either for the state or for the counties where the crop fed upon occurs. Two and three indicate a medium or average infestation with little damage. Four and five indicate a heavy infestation with more or less severe damage. The difference is that severe damage in fields now and then or in a group of farms where surrounding fields or farms are less damaged, are graded as four. Where the damage is extensive and has involved every farm, orchard, or herd, the ranking is 5. It is unusual to obtain an average of reports to equal 5. In such cases all reports averaged must be five. In ranking the counties on the basis of insect infestation, not all of the figures are mathematical averages of reports. Generally they are, but if additional information was available, making it advisable to alter such values, the change was made. The figures indicating population, therefore, tend toward conservatism.

The more significant summary maps of some of the important insects of the state are appended to this paper.

There are 105 counties in Kansas. The state is somewhat naturally divisible on the basis of soil, crops and rainfall, into three major areas—eastern, central and western Kansas. Divisions on the basis of major

crop areas (Fig. 1), is, however, a more desirable one for indicating and recording populations of the more important insects.

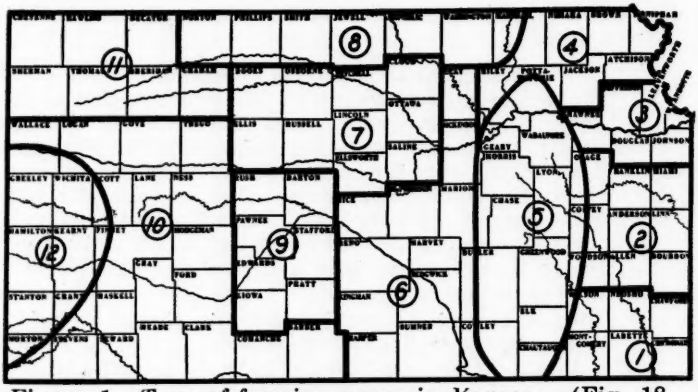


Figure 1—Type-of-farming areas in Kansas. (Fig. 18 of Kans. Agri. Exp. Sta. Bul. No. 251, 1930, which see for detailed explanation of the areas). Briefly, the areas are: A. Eastern Kansas—1, 2, general farming areas; 3, Kaw Valley, potato and legume area; 4, corn belt and northeastern apple district; 5, Long grass or "flint hills" section. B. Central Kansas—6, 7, 9, wheat belt; 8, central corn belt. C. Western Kansas—10, 11, 12, western wheat and grazing belt.

Summary Report on the Insects of the State for 1931

In the following paragraphs, will be given a brief summary of the prevalence of the insects which were included in the reports, or upon which sufficient information is available to justify some definite statements. The arrangement of the insects is approximately alphabetical.

The Army Worm (**Cirphis unipuncta**)

The presence of army worms was indicated in 43 counties. However, the term "army worm" is used by farmers and some others for a half dozen or more Noctuids, so the reports are almost without significance.

No outbreaks of the true army worm (**Cirphis unipuncta**) occurred in the state during 1931. This insect was less common than usual. There was a fairly severe outbreak of the army cutworm in March and

April over most of the state, and similar damage by the variegated cutworm during May and June. During September and November there was some damage by the fall army worm. The first two are discussed under "cutworms" and the latter under the "fall army worm".

The Evergreen Bagworm
(**Thyridopteryx ephemeraeformis**)

The population of the evergreen bag worm was sufficient to do noticeable damage in only the eastern third of the state. It was severest in Riley, Atchison, Doniphan, Leavenworth, Shawnee, Chase, Lyon, Greenwood, Allen and Bourbon counties. At Manhatttan, several arbor-vitae trees and hedges were observed to have been severely damaged. The belief exists among entomologists of the state that this insect has been building up in numbers since about 1920.

Blister Beetles

There was approximately a state-wide outbreak of blister beetles during 1931, damaging gardens and alfalfa fields in particular. A dry season, such as existed during 1931, appears to be particularly favorable to these insects. All sections except the southwest counties reported blister beetle damage.

Bot Flies (**Gastrophilus** spp.)

Bot flies were perhaps somewhat less numerous than usual in Kansas during 1931. Bot flies were reported from 63 counties. No county has been rated at 4 or 5. Seven counties have been rated at 3; 35 counties at 2, and 21 counties at 1. There is no significant grouping of counties, except that they were apparently unimportant in southwest Kansas. These insects are statewide in distribution.

Imported Cabbage Worm (**Pieris rapae**)

The common cabbage worm does not fluctuate in numbers very greatly in the state from year to year. It is about as plentiful or destructive as it is allowed to become every year. Reports from 76 counties on cabbage worms for 1931 were assembled. Of this number, 4 counties—Wyandotte, Neosho, Geary and Smith, have been scored at 5, which is as plentiful and destructive as they ever become. Seventeen counties have been rated at 4; 32 counties have been scored at 3; 19 counties at 2, and 8 counties at 1. The severest damage from cabbage worms was apparently confined to the eastern two-

thirds of the state, though some counties in southwest-central Kansas have been scored at 3 or 4.

Cattle Grubs or Ox Warbles (**Hypoderma lineata**)

Cattle grubs were reported from 84 counties from all parts of the state in 1931. This insect is being looked upon as an increasingly serious pest because of the effect on the general health of the animals and the dockage when the animals are sold. An animal with 10 or more grubs is docked sometimes as much as $2 to several cents a pound, while animals with 50 or more grubs are often refused at any price.

Cattle grubs do not fluctuate greatly in numbers, so far as is known. Smith County reported severest damage (5), while 18 counties reported the population at 4; 53 counties placed the population at 3; 7 counties at 2; and 4 counties at 1.

There is no significant grouping of counties as to population. This pest occurs all over the state and the population in range cattle last year was observed and reported to be particularly heavy. A dry spring, while the warbles are in the pupal stage, is favorable for development and consequently to a high population.

So far as is known, the northern ox warble (**Hypoderma bovis**) is not found in Kansas. It appears to be spreading southward so that it may become established in the state in the near future.

Cattle Lice
(**Haematopinus eurysternus** and **Linognathus vituli**)

There were more reports of infested cattle, particu-

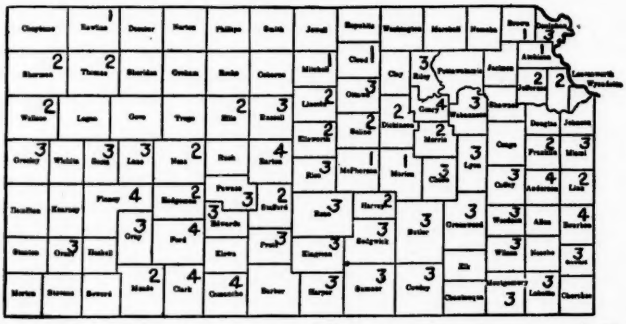


Figure 2.—Summary map of Kansas showing population of cattle lice during 1931.

larly with sucking lice, during the spring of 1931 than usual. Reports of cattle lice were received from 64 counties (Fig. 2). Eight counties—Bourbon, Anderson, Barton, Comanche, Clark, Ford, Geary and Finney—have been scored at 4 or in local outbreaks. Thirty-one counties have been rated at 3; 18 counties at 2, and 7 counties at 1.

The infestation appears to have been state-wide, excepting north central Kansas. The short nosed ox louse (**H. eurysternus**) was about four times as plentiful in Riley and Geary Counties as the long nosed.

Common Stalk borer (**Papaipema nebris**)

The publicity given the European corn borer in the East has caused an increasing number of farmers to watch for it, and many corn stalk borers are sent in as European corn borer suspects. It is doubtful whether the stalk borer occurs in outbreak proportions or whether they are increasing in numbers, but the increase in correspondence about this species leads one to believe that it may be on the increase in the state.

Reports are available from 23 counties concerning stalk borers, the counties being grouped almost entirely in the eastern third of the state. They were apparently most numerous in southwest Kansas.

Linn County reported them as 5, while Nemaha was rated at 4. Five counties—Bourbon, Shawnee, Cowley, Riley and Sedgwick—were rated at 3; 9 counties scored them at 2, and 8 at 1.

While this insect is commonly seen and reported attacking corn, the larvae also bore in the stems of many other plants, including wheat, oats, potatoes, smartweed and many other kinds of weeds.

Spring and Fall Canker Worms

(**Paleacrita vernata** and **Alsophila pometaria**)

Canker worm adults appeared in January, 1931, and continued to emerge through April. Considerable injury was done by the larvae, chiefly to elms, in the eastern part of the state. Trees about one-third defoliated by canker worms were observed by the writer in Riley and Shawnee Counties. The fall canker worm ordinarily emerges from December to February in Kan-

sas, and is followed by the spring canker worm.

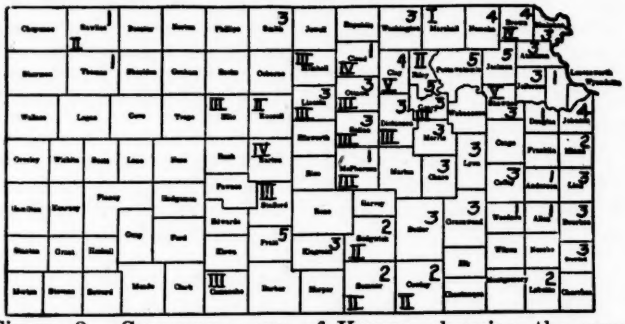


Figure 3.—Summary map of Kansas showing the populations of Walnut worms (1,2,3,4,5) and of the spring canker worm (I, II, III, IV, V) during 1931.

Reports on canker worms were received from 15 counties (Fig. 3). Two counties—Clay and Shawnee—have been scored at 5. Three counties have been rated at 4; 10 counties at 3; 6 counties at 2, and 1 at 1.

It appears that there was a small outbreak of spring and fall canker worms in 1931 which was severest in the central portion of the state and in the Kaw valley.

The Chinch Bug (**Blissus leucopterus**)

Chinch bugs appeared in local outbreaks in Kansas during 1931, only in the southeastern part of the state (Fig. 4). The dry winter and summer were favorable to chinch bugs.

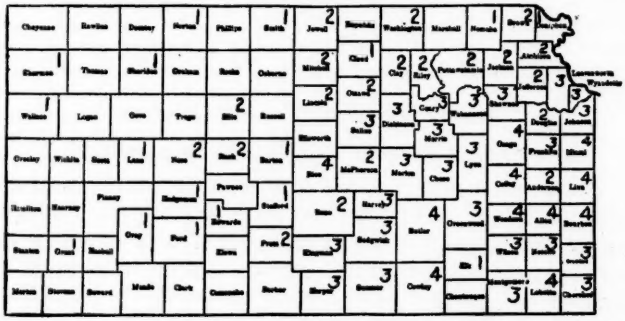


Figure 4.—Summary map of Kansas showing population of chinch bugs during 1931.

Reports on chinch bugs were received from 74 counties for 1931. No counties have been scored at 5 or in general outbreaks. Eleven counties have beeen scored at 4; 24 counties reported them at 3; 20 counties were scored at 2, and 16 counties at 1. This would indicate that chinch bugs were somewhat less plentiful than usual in Kansas. They were most numerous in the eastern part of the state, particularly the three eastern tiers of counties.

False Chinch Bug (**Nysius ericae**)

There was an unusual number of inquiries, chiefly from western Kansas, about the presence of the false chinch bug in newly thrashed wheat and in wheat grain piled on the ground. This insect is only occasionally seen or reported in any abundance in Kansas. Some weeds, particularly pepper grass, serve as its normal food plant. It is believed that the dry weather caused their host plants in the wheat fields to become hard and dry, forcing the bugs to scatter. Some may have sought shelter in the wheat piles. No injury to wheat grain was done. The large majority of specimens sent to this department for identification, chiefly during June and July, were nymphs.

The Corn Ear Worm (**Heliothis obsoleta**)

A large population of the corn ear worm was one of the features of the 1931 season. There was more injury to the heart leaves of young corn by the first generation of larvae than usual. This injury is sometimes called "ragworm" or "bud worm" damage. There were

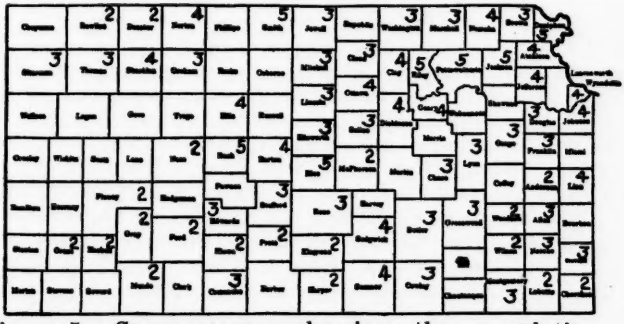


Figure 5.—Summary map showing the population of of corn ear worms in Kansas during 1931.

more letters of inquiry about this injury than in recent years. The second generation at Manhattan was not much more abundant than usual while the third generation was a very large one and approximately 100% of the ears of field corn showed ear worm damage. The infestation was independent of the planting date according to Professor D. A. Wilbur. Heads of sorghum were heavily infested and much seed damage was observed. There was also considerable leaf damage by these insects to alfalfa in the fall though inquiries from over the state were somewhat fewer than in other years.

Reports were received from 70 counties on corn ear worm population (Fig. 5). Seven counties—Doniphan, Jackson, Pottawatomie, Riley, Rice, Smith and Rush, were scored at 5. Sixteen counties were scored at 4; 28 counties at 3, and 19 counties at 2.

The Codling Moth (**Carpocapsa pomonella**)

The codling moth is, of course, confined to the apple-growing sections of the state and there are no wide fluctuations in number from year to year. A vigorous spraying schedule, of six to eight sprays, is necessary every year to keep them down and produce a salable crop of fruit.

The apple-growing areas include the counties in northeast Kansas—Nemaha to Doniphan, Doniphan to Wyandotte, and Shawnee to Wyandotte, and the counties around Wichita—Sedgwick, Harvey, Sumner, and Cowley. Sedgwick and Sumner Counties had the highest reported percentage of damage. The codling moth has been rated from 3 to 5 in the apple growing counties.

Cutworms

The reports on cutworms are open to conjecture as to the species involved, (Fig. 6). Most folks refer to several species of cutworms as army worms and there is, therefore, confusion between these two groups.

There were local outbreaks of the army cutworm and the variegated cutworm in alfalfa fields of Riley County during April, May and June. The variegated cutworm reached enormous numbers in a field of vetch at the college horticultural orchard and considerable damage to apple and cherry trees (Plate 1, Fig. 3) and to grapes was done before these insects could be checked. The worms climbed up the apple trees and ate the developing apples. They also ate patches of bark from apple and cherry trees. Several sowings of bran mash resulted in almost complete destruction of the brood.

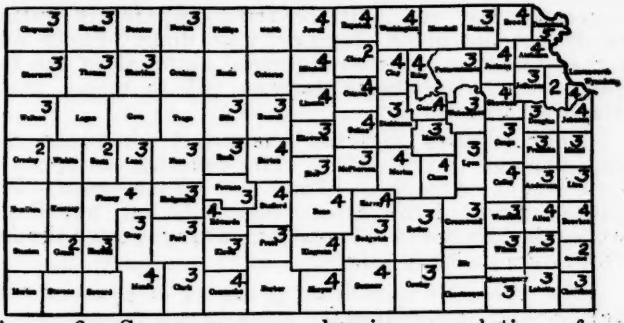


Figure 6.—Summary map showing population of cut worms in Kansas during 1931.

Reports are available, presumably of the two above species of cutworms, from 83 counties. They were scored at 5 or in general outbreak in only one county, viz, Doniphan County. The average of the reports from 32 counties indicated the population of these species at 4. They were rated at 3 in 46 counties and at 2 in 4 counties.

There were therefore, wide-spread outbreaks of cutworms in the state in 1931, extending from the eastern tier of counties to within three tiers of counties of the western line. The outbreaks were especially severe in the eastern and southcentral part of the state.

Biting Flies on Domestic Animals

There was no marked outbreak of stable and horn flies in Kansas during 1931. They are nearly always plentiful in the state.

Thirteen counties reported these flies at 4, or locally troublesome to stock. These counties were Neosho, Woodson, Washington, Marion, Saline, Ottawa, Smith, Rooks, Comanche, Gray, Haskell, Sherman and Wallace. Nineteen counties rated these flies at 3; 44 counties at 2, and 13 counties at 1.

The distribution was state-wide, there being no significant grouping of counties.

A small local outbreak of black flies (**Simulium vittatum**) occurred near Wamego and Westmoreland (Pottawatomie County) during May. A marked outbreak of black flies occurred in the lower Mississippi River Valley at the same time.

The Fall Army Worm (**Laphygma frugiperda**)

This species was less abundant during 1931 than is

frequently the case. It occurred apparently rather widely but not much damage was done. Smith and Harvey Counties reported a general outbreak of the fall army worm with severe damage (5) to crops, particularly alfalfa.

Four counties reported the insect abundant and some damage to crops (3). The counties so reporting were Miami, Atchison, Riley, and Washington. Ten counties reported the insect plentiful, but not doing noticeable damage (2). Twenty counties reported the fall army worm as being scarce.

No especially significant grouping of counties with high population occurred.

False Wireworm (*Eleodes* spp.)

There was a marked outbreak of false wireworms in Kansas during 1931. It is reported that in some counties not over 25% of the wheat was sown because of these insects and the dry weather. False wireworms are most damaging to fall sown wheat when the soil is so dry that germination is delayed and growth is slow. Under such conditions the larvae of these insects destroy the wheat grains and farmers have learned not to sow until rains come. Adults were unusually plentiful in September and October in Riley County. This county is about the eastern limit of distribution of the common destructive species.

These insects were reported in general outbreak in 10 counties. These counties were Greeley, Finney, Hodgeman, Ford, Meade, Gray, Ness, Edwards, Barton and Mitchell. They were scored at 4 in 11 counties; 18 at 3; 9 counties at 2, and 7 counties at 1.

There is a significant grouping of counties where false wireworms were most severe. The counties west of the tier from Jewell to Kingman and east of the tier from Thomas to Grant, included those of highest population.

Fleas (in homes)

There was no unusual number of house infestations by cat and dog fleas reported during 1931. They are worst in a warm, moist season and are most troublesome in homes during the spring.

Twenty-seven counties reported observations on fleas. Four counties—Doniphan, Geary, Saline and Montgomery—have been rated at 4; four counties at 3; five counties at 2, and 13 at 1.

There is no significant grouping of the heaviest infested counties.

Grain Weevils

Grain weevils, the rice (**Sitophilus oryzae**) and the common granary (**S. granaria**) weevils, were exceptionally abundant during 1931 in Kansas. As a result of the low price, many farmers have held somewhat longer than usual much of the two large wheat crops of 1930 and 1931. Lacking storing place in buildings, many farmers piled some or all of their wheat on the ground. These conditions were ideal for a high grain weevil population.

Several instances of rice weevil in wheat direct from the combines came to the notice of the staff of the Department of Entomology. This indicates that the beetles flew to the fields and laid eggs in the ripening wheat.

Reports on grain weevils were received from 65 counties. These insects have been scored at 5 in two of them—Coffey and Ellis. Sixteen counties have been rated at 4; 36 counties at 3; 16 counties at 2, and 5 counties at 1.

The infestation was state-wide and no significant grouping of counties with heavier damage is observable. The reports from the central two-thirds of the state, which would include the main wheat-producing countries, indicated that the damage was almost uniformly at medium to severe.

Garden Webworm (**Loxostege similalis**)

There was a light, scattered outbreak of the garden webworm in alfalfa in Kansas during 1931 (Fig. 7). The outbreak was unusual in that the first generation of larvae for the first time in at least 12 years did noticeable damage. The first and third generations usually do no appreciable damage, while the second does the commercial damage. During the summer of 1931, the first generation began damaging the second crop of alfalfa the latter part of June and continued until the middle of July. The second generation did its damage from the latter part of July until about the middle of August. The third generation was very scarce and did practically no damage. The first generation of garden webworms appeared about 10 days or two weeks earlier than usual. This may possibly explain the damage by this generation of larvae.

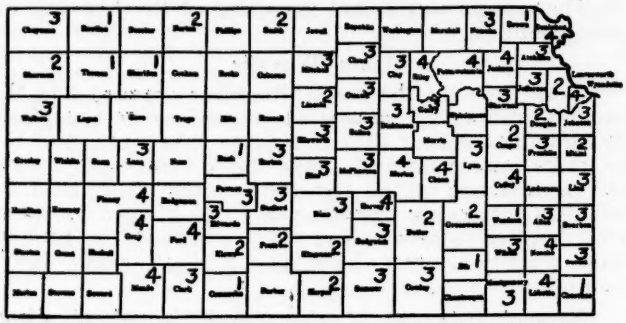


Figure 7.—Summary map showing the population of garden web worms in Kansas during 1931.

In fifteen counties the garden webworm was rated at 4; 33 counties have been rated at 3; 14 counties at 2, and eight counties at 1. The counties with higher ratings are significantly grouped in the eastern and southwestern parts of the state. In no fields, was complete destruction seen, but damage by loss of 30 to 40% of the foliage occurred in some fields in Riley County.

Grasshoppers

An unusual amount of newspaper publicity has caused many people to believe there was a severe, general, state-wide, grasshopper outbreak in Kansas during 1931. Grasshoppers were abundant over practically the whole state, but severe damage occurred only in the northwestern and northeastern counties (Fig. 8).

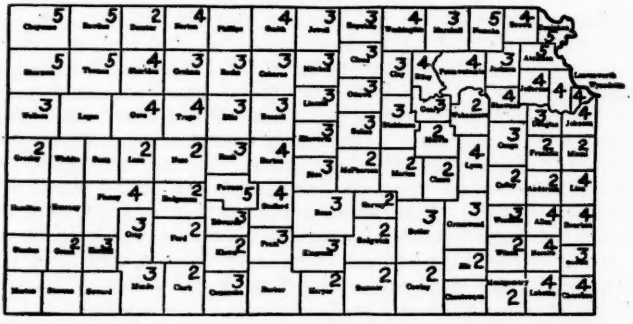


Figure 8.—Summary map showing the population of grasshoppers in Kansas during 1931.

Over the remainder of the state, they were only moderately abundant, and relatively little damage was done.

Seven counties reported grasshoppers in general outbreak. These counties were (in northeastern Kansas) Doniphan, Atchison, and Nemaha; (in northwestern Kansas) Cheyenne, Rawlins, Sherman and Thomas. In twenty-one counties grasshoppers were rated at 4; 33 at 3; and 24 at 2. The rating reports of 1 (scarce) were not included because, as is well known, grasshoppers are yearly fairly plentiful in Kansas, hence all the remaining counties may be rated at 1 or possibly 2. The species involved were the two-lined, the differential, and the lesser migratory. All of these species developed locally and they did not migrate from other counties or neighboring states.

There was a heavy deposition of eggs during the dry fall of 1930. The dry, mild winter following was favorable. June and July were dry and also favorable. Many reported failures to obtain satisfactory control with poisoned bran mash were found to be due to using lead arsenate instead of white arsenic, and 25% sodium arsenite (weed killer) at the same rate as recommended for 50% sodium arsenite.

Green Bug (**Toxoptera graminum**)

The spring grain aphid, popularly called the "green bug" in Kansas was unusually scarce in the spring of 1931. Edwards County reported some local outbreaks. Harper, Reno and Montgomery reported them as plentiful. It is believed that some damage attributed to the green bug in the south-central part of the state may have been caused by the clover mite (**Bryobia pratensis**).

Harlequin Cabbage Bug

This insect was not plentiful during 1931. They were rated at 4 in Labette County, while four counties were rated at 3; eight counties rated them at 2, and 20 counties at 1. They were graded at 2 in Riley County.

Hessian Fly (**Mayetiola destructor**)

There was no outbreak of Hessian fly in wheat during 1931 (Fig. 9). In fact, the state may be rated at about 2. The Hessian fly thrives best in a moist or wet season. 1931 was, therefore, not a favorable year for it. The only counties reporting heavy infestations were in northwestern and northeastern Kansas.

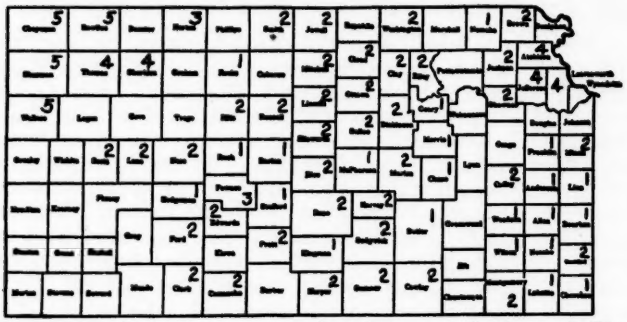


Figure 9.—Summary map showing population of Hessian fly in Kansas during 1931.

Reports from 72 counties were obtained on the Hessian fly. Severest damage (5) was reported in four counties—Rawlins, Wallace, Sherman, and Cheyenne. Four counties—Thomas, Sheridan, Atchison and Jefferson—were rated at 4 or locally abundant; two counties at 3; 37 counties at 2, and 24 counties at 1.

A local outbreak occurred in northwest Kansas. This is very interesting because the Hessian fly was absent from this region until about eight years ago. In the northern part of Jefferson County, complete loss of experimental plantings of wheat occurred, according to Dr. R. H. Painter, while in the southern part of the county there was a very light infestation. In the state as a whole, the Hessian fly was less plentiful and less destructive than usual.

Horse Flies (**Tabanus** spp.)

Horse flies were relatively scarce during 1931 in Kansas. Fifty-seven counties reported upon them, but only Marion County was rated at 5. Three counties were rated at 4; 10 counties at 3; and 33 counties at 2. Horse flies were most plentiful in the eastern and southern parts of the state.

Leafhoppers

Leafhoppers were plentiful on alfalfa in August and on apples during September, though as far as known, the population was about average.

Six counties—Doniphan, Atchison, Labette, Sedgwick, Sumner, and Riley—have been rated at 4, eight counties have been rated at 3, and 5 counties at 2.

Leafhoppers were plentiful on grapes and Virginia creeper during June and July in Riley County. They were not particularly abundant on potatoes in the Kaw Valley. **Empoasca** is always serious on potatoes, but they were about average (3) during 1931. The chief injury to apples occurred in northeast Kansas and in the Arkansas Valley districts.

Mites (on plants), (**Bryobia pratensis**)

There was severe damage to wheat in south-central Kansas during April and May by the red clover mites (**Bryobia pratensis**). The pest causes the wheat to appear yellowish and the tips of the leaves to turn brown as if frosted. An area extending as a band across the state from Riley County to Grant experienced most trouble from mites. It was mostly serious in southwestern and south-central Kansas.

Three counties—Douglas, Riley and Pawnee—have been rated at 4. Eight counties were rated at 3; 11 counties at 2, and 4 counties at 1. This mite did considerable damage to apple in the Arkansas River Valley during the summer.

The first outbreak of this mite occurred in Kansas in 1923. Since then, it has been of increasing importance on wheat in the spring. Later it goes to fruit trees, particularly apple, for the summer. It overwinters in the adult stage in wheat fields and on weeds.

Mange Mites on Cattle and Hogs

While the reliability of some of the reports on these pests may be open to question, there were wide-spread reports of local abundance and damage by mange mites, particularly on hogs.

Thirty-eight counties in the state reported that mange mites were present on hogs. They were ranked at 4 in Saline County, and at 3 in Atchison, Neosho, Greenwood, Smith and Ellis Counties. Eleven counties were rated at 2, and 21 counties at 1. There was no general outbreak in the state in 1931, but the reports indicate that their presence was state wide.

The distribution of mange mites on cattle was also state wide, but less frequent, apparently. Twenty counties reported them as present. Saline County has been rated at 4; Rooks County at 3; Linn, Dickinson, McPherson and Ness at 2, and the remaining 14 at 1.

Plant Lice

Two striking features of the year 1931 were the most pronounced outbreak of the arbor-vitae aphid (**Dilachnus tujafilimus**) (Plate I, Fig. 1) during May which has occurred for at least 12 years, and severe local outbreaks of the pea aphid on alfalfa (Plate I, Fig. 5). The green ash aphid (**Prociphilus sp.**) was plentiful during April in Riley and Pottawatomie Counties, but it frequently is plentiful though not particularly destructive. No distinction was made as to species on most of the questionnaires, so the data are only partially useful.

The pea aphid was most severe in south-central Kansas—in McPherson, Rice, Barton, Stafford, Reno, Sedgwick, Pawnee, Hodgeman, Finney, Chase, Ford, Saline, Edwards, Kearney, Mitchell, and Ellsworth Counties. They were ranked at 3 in the eastern two or three tiers of counties. The damage was quite local, being present in only certain fields in a community.

The arbor-vitae aphid was present in Riley, Dickinson, Saline, and Douglas Counties. Our data on this point are very inadequate, but it appears to have been most plentiful in the Kaw Valley.

The melon aphid (**Aphis gossypii**) was not particularly abundant. It was probably less destructive than usual. This same statement applies to the plum aphid (**Hysteroneura setariae**), the black cherry aphid and apple aphids. There was a fairly heavy infestation of the rosy and green apple aphids in northwestern Kansas.

Red Spider (**Tetranychus telarius**)

Red spiders were scarce in Kansas during 1931. They were unusually plentiful during 1930, however. Judging from the questionnaire replies, red spiders were most plentiful (3) in the Kaw Valley and the three or four tiers of counties east of the middle line of the state.

They were rated at 4 in Neosho, Cowley, and Washington Counties. Twenty-six counties reported red spiders present. They were scarce in Riley County.

Scale Insects

Scale insects in general increased slightly during 1931, according to Prof. Geo. A. Dean. While the San Jose scale has been reduced to small numbers in the state through the activities of the Entomological Com-

mission of Kansas, it is known to have increased materially during the year, largely because of high winter survival.

The European elm scale has recently entered this state and apparently is increasing in the central-southern part of the state. There was also a sporadic outbreak at Goodland.

Seed Corn Maggot

The seed corn maggot was unusually plentiful during April, May and June through the questionnaire replies did not indicate this. More than the usual number of letters and personal inquiries were noted during this period. The injuries were most marked to sprouting corn, both the sweet and field varieties, beans, watermelon and potatoes. Heavy rains and continued cold, wet weather at the time of planting of these crops were favorable to these insects and greater damage occurred than usual.

The questionnaire yielded no information of importance on this pest. Hodgeman and Lyon Counties were listed at 4. Washington, Riley and Jefferson at 3, and 6 counties at 1. This insect is most important in the eastern third of the state.

Strawberry Leaf-Roller (**Ancylus comptana**)

Twenty-four counties reported the presence of the strawberry leaf-roller. Geary County was rated at 4. Shawnee, Riley, McPherson, and Jewell Counties were rated at 3. Six counties were rated at 2, and 13 counties at 1. There was no outbreak of this pest but it was most frequently observed in northeast and central Kansas.

Work at this station has indicated an almost total destruction of this insect by parasites in 1929. The insect has since been scarce in this region. It has not caused any noticeable damage around Manhattan and none has been reported. There was severe damage in 1928 and during the spring of 1929, according to Dr. R. L. Parker.

Termites (**Reticulotermes flavipes**)

Termites are of increasing importance in Kansas with reference to their damage of buildings. Termite damage was reported for the entire eastern half of the state in the questionnaire. The grouping of counties of highest reported damage is significant in that severest

damage occurred in the central part of the state, while these insects were apparently of little consequence in the extreme western counties.

Sixty-seven counties reported on termites. Local outbreaks of termites (4) were reported for 10 counties —Rice, Doniphan, Atchison, Linn, Riley, Dickinson, McPherson, Mitchell, Ellsworth, Rice, and Smith Counties. They were rated at 3 in thirty-seven counties; at 2 in 5 counties and at 1 in 15 counties.

Walnut Worms (**Datana spp.**)

Several species of Datanas were more abundant than usual during 1931. The walnut caterpillar (**Datana integerrima**) had two generations, both of which did considerable defoliation of walnut trees. Colonies of larvae were present in most walnut trees, particularly during the latter part of August and early September, and at least partial defoliation was almost universal in Riley and neighboring counties.

The questionnaire showed that this insect was confined almost entirely to the eastern third of the state (Fig. 3). Forty counties reported on the insect. They were rated at 5 in five counties—Atchison, Jackson, Brown, Riley, and Pratt; at 4 in 5 other counties; at 3 in 22 counties; at 2 in 8 counties and at 1 in 14 counties.

The Datana on Oaks (**Datana ministra**)

This insect was more plentiful and destructive than usual during 1931. There were many oak trees in Riley County, partially defoliated by these larvae during September and October (Plate I, Fig. 4), and a few entirely defoliated by these and by an undetermined Notodont, which was unusually plentiful on both oaks and elms.

The Datana on Apple (**Datana ministra**)

This Datana was more plentiful and destructive than usual during June and July. This insect was apparently most plentiful in the Kaw Valley counties on apple seedlings. It was observed on several bearing apple trees, where limbs of trees in Riley County were defoliated.

The Datana on Sumac (**Datana** sp.)

This insect defoliated most of the Staghorn sumac on the college campus during September and October. This is the first time in recent years this has occurred. No data for other counties than this (Riley) were available.

Wheat Straw Worm (**Harmolita grandis**)

The wheat straw worm was plentiful over all but the eastern third of the state. While not particularly destructive, its presence was noted in 46 counties. It was most destructive apparently in northwest Kansas and in a band of counties extending diagonally across the state from Clay to Grant counties.

The joint worm (**Harmolita tritici**), according to Dr. E. G. Kelly, occurs in the eastern counties of Kansas. The wheat straw worm is less common in eastern Kansas, but it does occur there. This insect was not reported at 5, or in general outbreak for any counties. Three counties—Sheridan, Hodgeman and Saline—have been rated at 4; 18 counties at 3; 12 counties at 2, and 11 counties at 1.

White Grubs

These insects were not particularly abundant nor destructive during 1931 in Kansas. They were present all over the state, judging from reports, but they were somewhat less destructive than usual.

Five counties—Linn, Wilson, Harvey, Pawnee and Ness—have been rated at 4; 19 counties at 3; 24 counties rated at 2, and 32 counties at 1.

Wire Worms (**Melanotus** spp.)

Damage by wire worms appears to have been confined to the eastern half of the state. Their damage was most apparent in the spring, particularly to very young corn. These insects appear to have been worst in southeast Kansas. There was no outbreak and the numbers were apparently about as usual.

Wire worms were rated in general outbreak (5) in Coffey County only. They were rated at 4 in six counties—Chase, Saline, Riley, Wilson, Atchison and Linn. Eleven counties were rated at 3; 12 counties at 2, and 19 counties at 1.

Tent Caterpillars

The apple tree tent caterpillar (**Malacosoma americana**) was observed to be plentiful on wild cherry in Riley and Pottawatomie Counties in April. These insects appear to be increasing, though there has been no commercial damage seen or reported. They were most numerous in 1931 in the Kaw Valley.

The fall webworm, (**Hyphantria cunea**) was plentiful in the eastern half of the state during August, though

no real damage was done. Dickinson, Kingman, and Johnson Counties have been rated at 3; eight counties were rated at 2, and 17 counties at 1.

Tobacco and Drug Store Beetles

These two insects have become prominent during the last few years as household pests in the state. They attack overstuffed furniture, in particular; also clothing, carpets and some food materials.

Letters of inquiry have come primarily from the larger cities and villages of the state. These insects were not included on the questionnaire, but the correspondence would appear to indicate that they were more abundant than usual during 1931.

Tomato Worms (**Protoparce sexta**)

This insect was unusually abundant during the summer of 1931 in Kansas(Plate I, Fig. 7). The winter apparently was favorable for a high survival. This insect has a state-wide distribution, but was less plentiful in the western third of the state than in the eastern two-thirds. The correspondence regarding these insects was larger than in recent years and defoliation to plants, even entire gardens, was common. They destroyed potato foliage in Riley County in both truck and city lot gardens.

Fifty-three counties reported on the tomato worm. Two counties—Riley, and Pottawatomie—rated these insects at 5. Six counties rate them at 4; 18 at 3; 7 counties at 2, and 20 counties at 1.

SUMMARY

The year 1931 was the second of two years of abnormally warm weather. The winter of 1930-1931 was dry and warm. The spring was cold and wet, a late cold wave with snow coming on March 24. The summer was hot and dry. The fall was dry until November, when good rains came.

The year was characterized by local outbreaks of grasshoppers, army cutworms, variegated cutworms, garden webworms, arbor-vitae aphids, pea aphids, red clover mite, blister beetles, and corn earworms (especially of the first generation). It was also characterized by the abnormal abundance over the state in localities of tomato worms, walnut, apple and oak Datanas, spring canker worms, sucking lice on cattle, ox warbles, ter-

mites, fall army worms, evergreen bag worms, false wireworms, seed corn maggots, termites, tobacco and drug store beetles, and fall webworms.

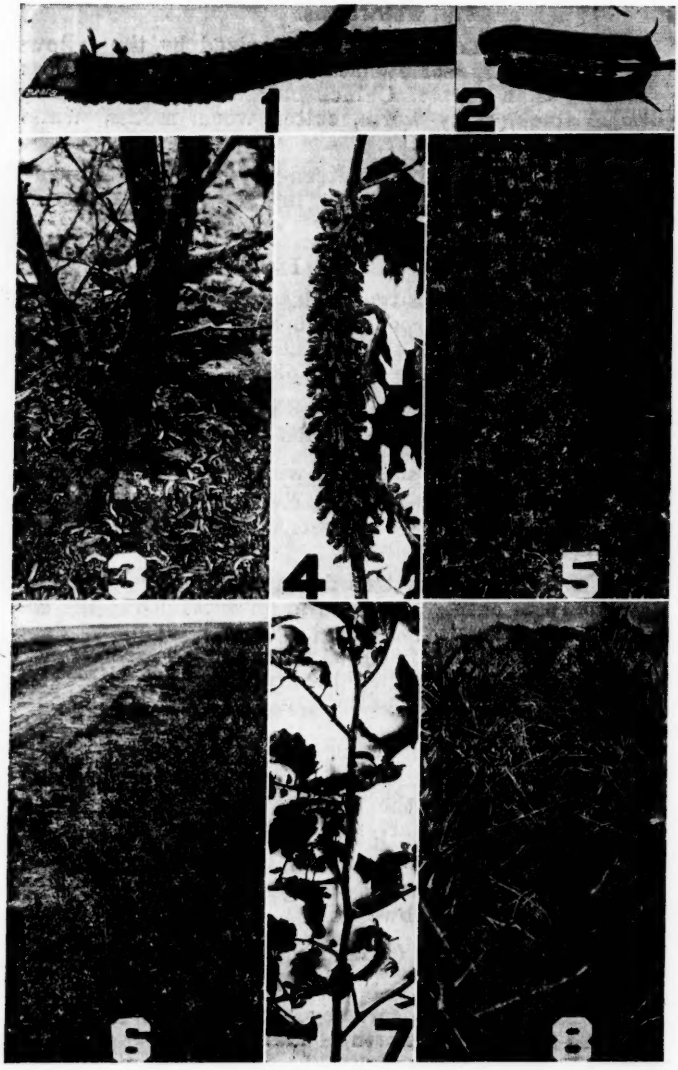
The year was further characterized by the following insects being somewhat less abundant and less damaging than usual: Chinch bugs, Hessian fly, biting flies on stock, army worm, cotton worm moths, white grubs, and wireworms.

Individuals of the seventeen-year cicada, following the emergence of a large brood in 1930 were not observed in the state.

PLATE I

Some of the more typical insect outbreaks of 1931. These photographs, except numbers 3 and 7, were made by Mr. Floyd Hanna, the Kansas State College photographer, who also made up the plate.

1. The arbor-vitae aphid. Limb from hedge on college campus. (Used by permission of Dr. R. L. Parker,)
2. Larvae of the thysbe clear-winged sphinx (**Haemorrhagia thysbe**), a species which defoliated bush honey suckle during 1931. (Courtesy of Dr. R. L. Parker.)
3. A Mahaleb cherry tree damaged by the variegated cut worm eating the bark, in an outbreak in the college horticultural orchard. Note the many dead larvae resulting from a sowing of poisoned bran mash. (Photographed by Professor W. F. Pickett, and used with his permission.)
4. A colony of oak Datanas. (By permission of Dr. Geo. A. Filinger.)
5. Alfalfa showing the usual short, bunchy growth characteristic of early damage by pea aphids.
6. Alfalfa in one of Mr. C. O. Grandfield's plots at the Agronomy farm showing severe foliage damage by the garden webworm.
7. Tomato worms (print from an old departmental negative).
8. Severe damage to corn by grasshoppers in a field near Rocky Ford north of Manhattan.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A NEW ARYTAINA (HOMOPTERA, CHERMIDAE)

By

ALLEN DOWELL, Lawrence, Kansas*

Arytaina snowi n. sp.

Allied to **A. montana** Crawford but differing from it by having tubercle on dorsal valve of ovipositor, and by pulverulent vertex, thorax and wings.

General color light to dark brown, head and thorax covered with whitish powder giving them a dirty whitish appearance. Length of body, female, 2 mm.; male, 1.7 mm. Length of forewing 2.4 mm. Width of head .8 mm.

Head not quite as broad as thorax, not strongly deflexed; vertex slightly over one-half as long as broad, rather large foveal impression on each side of median line, anterior margin truncate, posterior margin slightly concave; genal cones about two-thirds as long as vertex, widely divergent, broadly rounded at apex, rather densely pubescent. Antennae about one and two-thirds as long as width of head, very slender.

Thorax broad, not strongly arched, glabrous. Forewings about twice as long as broad, broadly rounded at apex, pterostigma wanting.

Genitalia.—Female.—Genital segment about as long as rest of abdomen, dorsal valve longer than ventral, more acute, with tuft of long hairs on prominent tubercle which is about midway on dorsal surface. Male.—Anal valve rather long, broad at base, converging to subacute apex, pubescent; forceps two-thirds as long as anal valve, rather narrow at base, enlarged somewhat subapically, pubescent.

Color. Vertex and genal cones light brown, sometimes covered with whitish powder which gives them a dirty whitish appearance; genal cones blackened around margin. Antennae straw yellow, terminal segment black, other segments except first two browned or blackened on apical portion. Thorax color of vertex, often marked with irregular brown spots; abdomen and genitalia varying from light brown to almost black. Forewings whitish, opaque, covered with whitish powder, maculated except on apical one-third; maculae consisting of small round brown spots, having no definite pattern, usually seven or eight rather large dark brown or

*Contribution from Department of Entomology, University of Kansas.

black spots around margin of wings.

Female **holotype,** male **allotype,** and three female **paratypes,** all from Santa Rita Mountains, Arizona, (F. H. Snow) 5-8000 ft., July.

Types in Snow Entomological Collection.

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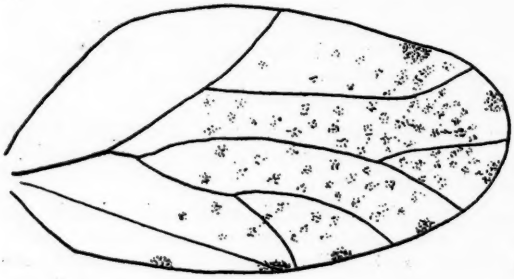

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Explanation of Plate

1. **Arytaina snowi,** cephalic aspect of head.
2. **Arytaina snowi,** forewing.
3. **Arytaina snowi,** female genitalia.
4. **Arytaina snowi,** male genitalia.

MINUTES OF THE EIGHTH ANNUAL MEETING OF THE KANSAS ENTOMOLOGICAL SOCIETY

April 16, 1932. McPherson College, McPherson, Kans.

BUSINESS MEETING

President R. H. Beamer called the annual meeting of the Society to order April 16, 1932, at 1:15 p. m., in room 203, Harnly Hall, McPherson College, McPherson, Kansas.

Reports of Officers

Minutes of the seventh annual meeting were read

and approved.

The treasurer made a report on the business of Volume IV of the Journal of the Kansas Entomological Society. He also gave a statement of the savings account and the assets and liabilities of the Society.

Reports of Committees.

Wild Life—Knaus and Lawson. Reported progress.
Publicity—Hungerford, Dean and Stephenson. No report.

Appointment of Committees by the President

Nominations Committee
W. Knaus, Chairman
Geo. A. Dean
P. B. Lawson

Resolutions Committee
P. A. Readio, Chairman
R. C. Smith
D. A. Wilbur

Auditing Committee
R. C. Smith
R. H. Painter

OLD BUSINESS—None

NEW BUSINESS

Papers

1. A Fossil Nepa from the Florissant (Read by title) ..... H. B. Hungerford
2. Notes on Apioceridae (Diptera) ..... R. H. Painter
3. Dormancy in Insects ..... P. A. Readio
4. A Summary of the Population of Injurious Insects in Kansas for 1931 ..... R. C. Smith
5. Some Observations on the Wheat Stem Maggot (Diptera, Chloropidae) .... M. W. Allen
6. Some Problems in Research Studies of Wireworms (Coleoptera, Elateridae).... H. R. Bryson
7. The Genus Spangbergiella (Homoptera, Cicadellidae) ..... P. B. Lawson
8. The Genus Parabolocratus (Homoptera, Cicadellidae) ..... J. Gilbert Shaw
9. The Genus Carneocephala (Homoptera, Cicadellidae) .... J. O. Nottingham
10. The Genus Xestocephalus (Homoptera, Cicadellidae) ..... Harold Peters
11. A Study of Native Prairie near Manhattan, Kansas, of Leafhopper Fauna (Homoptera, Cicadellidae) ..... D. A. Wilbur

FINAL BUSINESS

Reports of Special Committees

Motion made that the selection of the cover design half tones be left to the Publication Committee. Motion carried.

Resolutions Committee

Be it Resolved: That the Kansas Entomological Society express to the officials of McPherson College, to the officers of the Kansas Academy of Science, and to the Committee on Arrangements—Doctors Hershey, Knaus and Harnly—our appreciation for the excellent facilities provided for our meeting.

Be it Further Resolved: That the members of the Kansas Entomological Society extend congratulations to the entomologists of Colorado for their noteworthy accomplishments in baseball. We feel that with their excellent players, accompanied by their all-worthy score keeper, they can go a long way in winning ball games. May we advise them to retain, under all circumstances said score keeper, if they wish to continue their present notable success in defeating the powerful athletes of their neighboring state of Kansas.

(Signed) D. A. Wilbur
R. C. Smith
P. A. Readio

Be it Further Resolved: That the Kansas Entomological Society express its regret that its former president, Dr. P. M. Gilmer, has been transferred to other places of work. We shall miss him because of his enthusiastic personality and the inspiration of his work.

Motion made that respective resolutions be sent to G. M. List and P. M. Gilmer, Motion carried,

Nominations Committee.

President ..... R. H. Painter
Vice-President ..... P. A. Readio
Secretary-Treasurer ..... R. L. Parker

Motion made closing nominations. Motion carried.

Motion made that the secretary cast ballots electing officers for the ensuing year. They were so voted into office.

Motion made that the time and place of meeting be determined by the Executive Committee. Motion carried.

Motion made to adjourn. Motion carried. Meeting adjourned at 3:55 p. m.

There were 39 members and friends present from Lawrence, Manhattan, McPherson, Wichita, El Dorado, Kansas, and Kansas City, Missouri.

R. L. Parker, Secretary.

THE ROCKY MOUNTAIN CONFERENCE OF ENTOMOLOGISTS

This is to announce the Ninth Rocky Mountain Conference of Entomologists, to be held in Pingree Park, Colorado, August 15 to 20 inclusive.

George M. List, Secretary.

CONTENTS OF THIS NUMBER

A SUMMARY OF THE POPULATION OF INJURIOUS INSECTS IN KANSAS FOR 1931—ROGER C. SMITH 65

A NEW ARYTAINA (HOMOPTERA, CHERMIDAE)—ALLEN DOWELL - - 93

MINUTES OF THE EIGHTH ANNUAL MEETING OF THE KANSAS ENTOMOLOGICAL SOCIETY - 94

NINTH ROCKY MOUNTAIN CONFERENCE OF ENTOMOLOGISTS, PINGREE PARK, COLORADO, AUGUST 15 TO 20 INCLUSIVE. - - 96

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

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Manuscripts for publication may be sent to any of the publication committee.

Subscriptions should be sent to the office of Publication, 119 South Main Street, McPherson, Kansas.

KANSAS ENTOMOLOGICAL SOCIETY

President R. H. Beamer, University of Kansas, Lawrence.
Vice President P. M. Gilmer, Wichita.
Sec.-Treas. R. L. Parker, Kansas State College, Manhattan.

Subscription, $1.00 per year **Single copy, 40 cents**

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